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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/679,141	10/03/2003	Tatyana N. Andryushchenko	42.P16161D	3639

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EXAMINER	
WILKINS III, HARRY D	

ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 09/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

✓

Office Action Summary	**Application No.** 10/679,141	**Applicant(s)** ANDRYUSHCHENKO ET AL.	
	Examiner Harry D. Wilkins, III	**Art Unit** 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *23-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *23-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 18 August 2006 has been entered.

Claim Limitation Interpretation

2. The presently pending claims are directed to an apparatus. In apparatus claims, the article worked upon is not normally given patentable weight. See MPEP 2115. However, in this instance, the article being worked upon, the claimed wafer, is (1) actively recited and (2) must be electrically connected with an anodic bias to the barrier layer (e.g.-TaN) of the wafer, thus imparting some limited form of structure such that the structure be capable of applying an anodic bias to the barrier layer. However, in the apparatus of Hsu and Wang, once portions of the conductive layer of copper had been removed, the exposed barrier layer would have been subjected to electropolishing because current was still capable of flowing through the TaN barrier layer. The prior art recognized that a TaN barrier layer was sufficiently conductive to support a current in an electropolishing process. See Uzoh et al (US 5,807,165) at figures 5-6 and col. 4, line 55 to col. 5, line 40. Thus, in the apparatus of Hsu et al or Wang, had the electropolishing current continued to be applied after the barrier layer was exposed, the

barrier layer would have been considered to be immersed in the electrolyte and acting as an anode. Apparatus claims are not limited by the manner of operation. See MPEP 2114. Thus, since the apparatus of either Hsu or Wang was capable of operating to provide the anodic bias to the barrier layer, the claimed invention has failed to be structurally distinguished from the prior art apparatus.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 23-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al (US 2004/0067640) in view of Brogden et al (US 5,227,041).

Hsu et al teach electropolishing of a semiconductor wafer substrate (the silicon being the ILD with features such as trenches), an adhesion/barrier bilayer of Ta and TaN and copper deposited in the feature. The electropolishing would necessarily be carried out in a vessel, wherein the wafer was charged as an anode and a cathode was included and a power source for supplying the necessary voltage and current to carry out the electropolishing step.

Thus, Hsu et al fail to expressly teach a sealing wafer holder coupled around the perimeter of the wafer.

However, sealed wafer holders for electrolytic processing of semiconductor wafers were known, as shown by Brogden et al (see figures).

Therefore, it would have been obvious to one of ordinary skill in the art to have added a sealed wafer holder as taught by Brogden et al to the apparatus of Hsu et al for the purpose of maintaining an electrical connection to the seed layer (conductive layer) of the semiconductor wafer in a dry environment to avoid problems associated with wet electrical contacts (see col. 2 of Brogden et al).

The apparatus of Hsu et al was capable of operating such that the barrier layer of the wafer became exposed to the electrolyte and, since the barrier layer was sufficiently conductive to carry an electric current, to apply an anodic bias to the barrier layer.

Regarding claims 24-27, see MPEP 2115. The composition of the electrolyte contained within the claimed apparatus is not given patentable weight. The apparatus of Hsu et al would have been capable of operating with the claimed electrolyte.

Regarding claim 31, see MPEP 2114. The voltage applied by the power source is not given patentable weight as it relates to the manner of operation of the claimed cell. The apparatus of Hsu et al would have been capable of operating at the claimed voltage.

Regarding claims 32 and 33, Hsu et al do not teach including a reference electrode.

However, reference electrodes, including saturated calomel electrodes, are well-known in the electrolytic arts for the purpose of providing accurate measuring and control of applied potentials. See MPEP 2144.03.

Therefore, it would have been obvious to one of ordinary skill in the art to have added a standard saturated calomel reference to the apparatus for the purpose of providing accurate control of the applied potential.

5. Claims 23-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (US 6,395,152) in view of Pramanick et al (US 6,117,770) and Brogden et al (US 5,227,041).

Wang teaches (see figures 7A and 7B and col. 12, lines 4-25) an apparatus for electrolytic processing of semiconductor wafers comprising a vessel having an electrolyte therein, a first electrode at least partially immersed in the electrolyte including a wafer comprising an inter-layer dielectric having a feature therein (i.e.-trench or vias, col. 2, lines 5-15), a barrier layer of TaN and a conductive copper layer deposited in the feature, a second electrode immersed in the electrolyte and a potential source for applying a potential difference between the first and second electrodes.

Wang teaches (see col. 1, lines 1-12) that the apparatus was capable of operation in either electropolishing or deplating mode. When operating in the electropolishing mode the wafer surface was energized as an anode and the second electrode was energized as a cathode.

The apparatus of Wang was capable of operating such that the barrier layer of the wafer became exposed to the electrolyte and, since the barrier layer was sufficiently conductive to carry an electric current, to apply an anodic bias to the barrier layer.

Thus, Wang fails to teach (1) the under-layer deposited on the ILD and below the barrier layer and (2) that the wafer chuck (29) was a sealed wafer holder coupled around the perimeter of the wafer.

Pramanick et al teach (see col. 2, lines 11-28) bilayer barriers made from an adhesion layer of Ta, Ti or W metal, below a barrier layer of TaN. The adhesion layer ensures good adhesion of the barrier layer and good electrical contact of the barrier layer.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the adhesion layer of Pramanick et al into the wafer of Wang for the purpose of increasing adhesion and electrical contact of the barrier layer.

Sealed wafer holders for electrolytic processing of semiconductor wafers were known, as shown by Brogden et al (see figures).

Therefore, it would have been obvious to one of ordinary skill in the art to have added a sealed wafer holder as taught by Brogden et al to the apparatus of Wang for the purpose of maintaining an electrical connection to the seed layer of the semiconductor wafer in a dry environment to avoid problems associated with wet electrical contacts (see col. 2 of Brogden et al).

Regarding claims 24-27, see MPEP 2115. The composition of the electrolyte contained within the claimed apparatus is not given patentable weight. The apparatus of Wang would have been capable of operating with the claimed electrolyte.

Regarding claim 31, see MPEP 2114. The voltage applied by the power source is not given patentable weight as it relates to the manner of operation of the claimed cell. The apparatus of Wang would have been capable of operating at the claimed voltage.

Regarding claims 32 and 33, Wang does not teach including a reference electrode. However, reference electrodes, including saturated calomel electrodes, are well-known in the electrolytic arts for the purpose of providing accurate measuring and control of applied potentials. See MPEP 2144.03. Therefore, it would have been obvious to one of ordinary skill in the art to have added a standard saturated calomel reference to the apparatus for the purpose of providing accurate control of the applied potential.

Response to Arguments

Applicant's arguments filed 26 July 2006 have been fully considered but they are not persuasive. Applicant has argued that neither Hsu et al nor Wang teach that the barrier layer is electropolished.

In response, as noted above in paragraph 2, the claim limitation on which Applicant is arguing for patentability is related to the manner of operation of the claimed apparatus. As noted above, the prior art apparatus was *fully capable* of operating in the claimed fashion, and, as noted in MPEP 2114, apparatus claims cannot be distinguished from the prior art by the manner of operation when the prior art apparatus was capable of operating in the claimed manner. Each of the *structural* elements claimed by Applicant are present and taught by the prior art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Harry D Wilkins, III
Primary Examiner
Art Unit 1742

hdw